

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Article 36 and Rule 70)

Applicant's or agent's file reference AA 1613 PCT	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/GB 03/04290	International filing date (day/month/year) 01.10.2003	Priority date (day/month/year) 05.10.2002
International Patent Classification (IPC) or both national classification and IPC B01D53/94		
Applicant JOHNSON MATTHEY PUBLIC LIMITED COMPANY et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

- I Basis of the opinion
- II Priority
- III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV Lack of unity of invention
- V Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI Certain documents cited
- VII Certain defects in the international application
- VIII Certain observations on the international application

Date of submission of the demand 30.04.2004	Date of completion of this report 18.01.2005
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✓ **INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB 03/04290

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, Pages

1-10 as originally filed

Claims, Numbers

1-20 filed with telefax on 14.12.2004

Drawings, Sheets

1/5-5/5 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- the language of publication of the international application (under Rule 48.3(b)).
- the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- contained in the international application in written form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- the description, pages:
- the claims, Nos.: 21
- the drawings, sheets:

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5. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	
	No: Claims	1-20
Inventive step (IS)	Yes: Claims	
	No: Claims	1-20
Industrial applicability (IA)	Yes: Claims	1-20
	No: Claims	

2. Citations and explanations

see separate sheet

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EXAMINATION REPORT - SEPARATE SHEET**

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Ad Section V:

1. Amended claim 1 is directed to an exhaust gas system for a diesel engine comprising a second NO_x absorbent disposed upstream of a first NO_x absorbent. The exhaust system is characterised in that the second absorbent consists essentially of alumina and/or ceria.

EP-A-0.814.242 (D1) describes an exhaust gas system wherein a SO_x absorbent is disposed upstream of a NO_x absorbent (column 4, lines 34-35). Furthermore, it is stated that the SO_x absorbent also absorbs NO_x (column 4, lines 35-42). The NO_x absorbent comprises (a) at least one oxide selected from those of alkali metals, alkaline earth metals and rare earth metals, and (b) platinum group metals (claim 6). The SO_x absorbent may comprise at least one oxide selected from those of alkali metals, alkaline earth metals and rare earth metals, whereby cerium is explicitly mentioned (column 5, lines 24-29). Furthermore, it is stated that the absorbent is usually carried on a support, for instance alumina optionally admixed with ceria (column 5, lines 30-34). Hence, D1 discloses that the upstream absorbent in the exhaust gas system can consist essentially of alumina and ceria.

Thus, the exhaust gas system of amended claim 1 lacks novelty over the system known from D1 (Art.33(2) PCT).

2. EP-A-0.893.154 (D2) refers to a similar exhaust gas system comprising a first NO_x absorbent (7) which can function as an absorbent-catalyst by the addition of a noble metal component (column 3, lines 11-12; lines 43-46). The first NO_x absorbent (7) is preceded by a support member (6) carrying a oxidation catalyst on an upstream section and a sulphur adsorbent on a downstream section thereof (column 3, lines 17-21; lines 35-39; figure 1).

EP-A-1.101.908 (D3) also discloses an exhaust gas system with a SO_x absorbent (7) followed by a NO_x absorbent-catalyst (12).

Finally, WO-A-00.59611 (D4) relates to a NO_x absorbent catalyst comprising a carrier member coated with two discrete layers comprising a NO_x absorbent. The first or downstream layer comprises platinum whilst the second or upstream layer comprises palladium (claim 1).

However, neither one of D2, D3 or D4 refers to an upstream NO_x absorbent

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consisting essentially of alumina and/or ceria.

4. The features in the remaining claims are either also known from the prior art mentioned above or appear to be normal design options which the skilled person would select in accordance with the circumstances.
5. The description does not correspond to the amended claims (Art.6 PCT).

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CLAIMS:

1. An exhaust system for a diesel engine, which system comprising a NO_x-trap comprising at least one first NO_x absorbent and platinum, characterised in that at least one second NO_x absorbent consisting essentially of alumina and/or ceria is disposed upstream of the first NO_x-trap.
2. An exhaust system according to claim 1, wherein the first NO_x-absorbent is selected from the group consisting of alkaline earth metal compounds, alkali metal compounds, rare earth metal compounds and mixtures of any two or more thereof.
3. An exhaust system according to claim 2, wherein the or each alkaline earth metal is selected from the group consisting of barium, magnesium, strontium and calcium.
4. An exhaust system according to claim 2, wherein the or each alkali metal is selected from the group consisting of potassium and caesium.
5. An exhaust system according to claim 2, wherein the or each rare earth metal is selected from the group consisting of cerium, yttrium, lanthanum and praseodymium.
6. An exhaust system according to claim 2, 3, 4 or 5, wherein the or each alkaline earth metal compound, the or each alkali metal compound or the or each rare earth metal compound is supported on a support material.
7. An exhaust system according to claim 6, wherein the or each support is selected from the group consisting of alumina, silica, titania, zirconia, ceria and mixtures or a composite oxide of any two or more thereof.

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8. An exhaust system according to claim 6, wherein the first NO_x absorbent comprises the support.

9. An exhaust system according to any preceding claim, comprising a catalyst for oxidising NO to NO₂ disposed between the at least one second NO_x absorbent and the NO_x-trap.

10. An exhaust system according to claim 9, wherein the NO oxidation catalyst is platinum on an alumina support.

11. An exhaust system according to claim 9 or 10, comprising a particulate filter disposed between the oxidation catalyst and the NO_x-trap.

12. An exhaust system according to any of claims 1 to 10, wherein the NO_x-trap comprises a particulate filter.

13. An exhaust system according to any preceding claim, comprising a catalyst comprising a catalyst component for oxidising hydrocarbon and carbon monoxide to water and carbon dioxide and an oxygen storage component, which catalyst is disposed downstream of the NO_x-trap.

14. An exhaust system according to claim 13, wherein the oxidation catalyst comprises platinum or palladium supported on a bulk ceria-zirconia mixed oxide oxygen storage component.

15. A diesel engine comprising an exhaust system according to any preceding claim.

16. A light-duty diesel engine according to claim 15.

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17. An engine according to claim 15 or 16, comprising an engine control unit, when in use, intermittently to adjust the exhaust gas composition to the rich side for regenerating the at least one first NO_x absorbent.

18. A flow-through substrate comprising a NO_x-trap comprising a first zone coated with a composition comprising at least one first NO_x absorbent and platinum and a second zone coated with a composition comprising at least one second NO_x-absorbent, which at least one second NO_x absorbent consisting essentially of alumina and/or ceria.

19. A method of treating NO_x in the exhaust gas of a diesel engine, which method comprising (i) absorbing NO₂ from lean exhaust gas in at least one second NO_x absorbent consisting essentially of alumina and/or ceria when a downstream NO_x-trap comprising at least one first NO_x absorbent and platinum is inactive for reducing NO_x using a suitable reductant; (ii) thermally desorbing stored NO_x from the at least one second NO_x absorbent; and (iii) reducing NO_x on the NO_x-trap using a suitable reductant.

20. A method according to claim 19, comprising the step between steps (i) and (ii) of adsorbing NO_x on the at least one first NO_x absorbent.

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